Editorial

Nicola Augenti*

Department of Structures for Engineering and Architecture,
University of Naples Federico II,
via Claudio 21, 80125 Naples, Italy
Email: augenti@unina.it
*Corresponding author

Franco Bontempi

School of Civil and Industrial Engineering,
University of Roma La Sapienza,
via Eudossiana 18, 00184 Rome, Italy
Email: franco.bontempi@uniroma1.it

Bernardino Chiaia

Department of Structural, Geotechnical and Building Engineering,
Politecnico di Torino,
Corso Duca degli Abruzzi 24, 10129 Torino, Italy
Email: bernardino.chiaia@polito.it

This Special Issue on "New Trends and Findings in Forensic Engineering" originates from a series of initiatives in the field of Forensic Engineering (FE). In Italy, the last decade was characterised by an innovation process that moved in several directions by means of multiple activities and events.

From an educational viewpoint, a post-graduate MSc program in FE was launched by University of Naples Federico II, Naples, Italy. That was a key institutional step towards the FE dissemination in Italy and continental Europe. The MSc program was established by Nicola Augenti on 6 August 2008 and its eighth edition is ongoing, leading to a total number of 126 post-graduate students. The MSc program consists of five modules on law subjects and twelve modules on civil and industrial engineering topics. The great success of this MSc program lies in the job placement of its alumni, that are appointed by legal parties and judges to investigate the causes and responsibilities of civil and industrial accidents. The urgent need of creating legal offices in engineering firms is also a new source of recruitment for forensic engineers. A new class of Italian forensic engineers is then developing and a national register of technical consultants, which are rigorously selected, is being promoted by academics and magistrates.

The Italian Association of Forensic Engineering, established in Naples, Italy, in November 2009, is doing a great effort to disseminate FE in Italy. Such an association (whose Italian acronym is AIF) promotes FE through conferences, seminars and short courses, that are building up a multidisciplinary network of engineers, lawyers, private and public managers, and magistrates. The AIF mission includes a cooperation with

similar associations and committees, such as the ASCE Technical Council on Forensic Engineering in USA. Over the Italian territory, AIF is working with the FE technical committee of the Italian Council of Engineers to promote the official recognition of licensed forensic engineer, to define FE practice rules, and to support education programs in the field.

The third main stream of activities is the organisation of a conference series named IF CRASC, that is the Italian abbreviation of forensic engineering in conjunction with collapses, reliability and retrofit of structures. In detail, the traditional conference series on structural failure prediction, evaluation and repair (i.e. the CRASC component) was connected with a new conference series on FE (i.e. the IF component). The CRASC conferences were hold in Venice (2001), Naples (2003) and Messina (2006). Until now, three IF CRASC conferences took place in Naples (2009), Pisa (2012) and Rome (2015), highlighting a special interest by researchers, professionals, companies and public institutions.

This Special Issue attempts to provide a general view of the many facets and perspectives that characterise current research and practice in FE, contributing to delineate some novelties and outlooks in the field. To that aim, a selection of papers that were presented at the IF CRASC ’15 conference in Rome, Italy, is included. All papers were extended to attain a journal quality level and can be grouped in three categories: back-analysis of structural failures and accidents (five papers), risk assessment (four papers), and structural retrofit (one paper).

Among the first five papers mentioned above, the article “Investigation on the 2010 *Schola Armaturarum* collapse in Pompeii” by Nicola Augenti presents the main findings of a forensic investigation on the collapse of an ancient masonry building located in the archaeological site of Pompeii, Italy. Starting from a brief description of past events that led to the building configuration at the time of collapse, the paper provides details on the main phases and techniques of the investigation. The most probable sequence of damage is presented as it was suggested to the judicial authority that committed the author to investigate the causes and responsibilities of the collapse.

In the paper entitled “The collapse of a temporary structure”, Chiara Crosti et al. face the issue of structural design and safety of temporary facilities for music concerts. As a matter of fact, several recent collapses of those structures have increased the public attention on their construction and design procedures. In their paper, the authors present a back-analysis aimed at identifying the potential causes that led an aluminium truss structure to collapse. The study was based on nonlinear finite element analysis, which allowed a failure sequence to be derived. The forensic investigation included a comprehensive analysis of the whole construction process, highlighting an inadequate structural design and improper construction procedure.

The paper entitled “Fire investigation on a car park” by Cristina D’Angelo deals with the reconstruction of a fire event that developed at the ground floor of a multi-storey building, causing heavy damage to property. The formation and propagation of fire was modelled and the ignition of a car parked inside the building was found to be the most probable source of the fire, that suddenly propagated resulting in the loss of 38 cars and 8 motorcycles as well as failure of gas, water and electricity pipelines. The forensic investigation was based on fire testing and dynamic simulations, allowing a plausible event reconstruction to be performed. The interesting outcome of numerical simulations was the reproduction of the fire wave travel path, identifying the propagation process through cars and the acceleration caused by flammable ceilings.

Fire safety engineering and forensic assessment are also the subject of the paper "On the role of the numerical analyses in forensic investigations of fire-induced progressive collapses of tall buildings" by Filippo Gentili and Francesco Petrini. The authors critically review the responsibilities of several operators involved in fire safety strategies, with special emphasis on designers. Structural robustness of tall buildings subjected to fire hazard and advanced numerical procedures for back-analysis of fire-induced collapse phenomena are discussed. A methodology for a correct structural analysis and interpretation of numerical results is proposed and applied to a high-rise steel building as a case study.

The paper entitled "Collapse of corrugated metal culvert in Northern Sardinia: analysis and numerical simulations" by Linda Giresini et al. addresses the issue of structures that fail or even collapse as a consequence of corrosion and erosion phenomena. Based on finite element modelling and buckling analysis of a real structure that collapsed during an extreme rainfall event, a forensic analysis was performed. The outcomes of that analysis substantiate the catastrophic effect of combined erosion and corrosion that caused material degradation and improper water flow.

The second section of this Special Issue starts with the paper "A framework for NaTech seismic risk assessment in industrial plants" by Bernardino Chiaia et al. The authors present a novel approach for seismic vulnerability analysis, which is based on census data and multi-criteria analysis. Several issues pertaining refinery items are described, associating the industrial hazard with structural behaviour.

Risk analysis is then specialised to the case of transportation infrastructure through the paper "Risk analysis for severe traffic accidents in long road tunnels" by Konstantinos Gkoumas et al. The authors carried out a quantitative risk analysis of road tunnels by means of the PIARC-OECD model, detecting the subset of parameters that have major impact on risk. The theoretical approach was applied to an important tunnel located in Southern Italy.

A probabilistic risk evaluation is presented by Fulvio Parisi and Paola Russo in their paper entitled "Probabilistic risk analysis of building columns to gas pipeline explosions". The failure of natural-gas pipelines and potential damage to reinforced concrete buildings are taken into account. A probabilistic methodology was developed by considering the main physical features of the problem, from the gas jet release process to explosion effects on building columns. The proposed formulation may be useful in performance-based engineering and land use planning, as it allows the estimation of minimum pipeline-to-building safety distances associated with acceptable levels of risk.

The issue of industrial risk is further explored in the paper entitled "Seismic risk assessment of an industrial plant struck by the Emilia 2012 earthquakes" by Fabio Petruzzelli. Seismic loss predictions provided by a well-established methodology of quantitative risk assessment are compared to real losses induced by the 2012 Emilia earthquake sequence on a medical device production plant, which is located in the near-field region. The author presents a direct comparison between loss estimates and their adjusted values after real events, emphasising their satisfactory correlation level and hence the opportunity of using probabilistic approaches to support decision making.

A final contribution to this Special Issue is the paper "Durability of GFRP grids for masonry structures" by Luca Righetti et al., which falls in the field of structural retrofitting. The durability of grid embedded in textile reinforced mortars which are

externally bonded to masonry members is addressed. Based on a significant number of specific experimental tests, the degradation of mechanical properties was characterised and critically discussed.

We are quite confident in the interest the readers will find in methods and materials included in this Special Issue, allowing their direct implementation in FE activities. Every paper is typically characterised by theoretical and practice-oriented information, letting a general trend line to be traced for a comprehensive understanding of current and future directions in the field.

We would like to thank the Publisher, Editor-in-chief and Editorial Office for their support in several stages of the editorial process. Special thanks are due to the authors and reviewers of this issue.

Finally, we would like to acknowledge the valuable work of Fulvio Parisi, that is the Managing Guest Editor of this issue, who strongly assisted the Guest Editors from selection and invitation of authors to submission and acceptance of papers.